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NSA review
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14 JUN 1968

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MEMORANDUM FOR: Director of Special Activities

SUBJECT: Projected Soviet Bloc and Other Defensive
Environments Through the 1975-80 Period

REFERENCE: 8994-68 dated 6 May 1968

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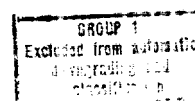
1. This memorandum is in response to your request that OSI project the defensive weapons environment of the "Soviet Bloc" and selected other countries into the 1975-1980 time period and endeavor to establish a performance envelope in which a survivable, quick reaction, aerodynamic, reconnaissance vehicle might viably operate. No clear delimitation of such an envelope has been possible but a number of judgments have been made regarding the survivability of such a vehicle which may serve as helpful guidelines during your concept study. These judgments are in Paragraph 25.

2. Projecting the threat into so distant a time period can be done, of course, only with some trepidation. Nevertheless, some directions of development in air and ABM defenses are evident and community estimates on the introduction of new equipment in this time period are available. The study which has been made focuses on the Soviet Union as presenting the most advanced threat in this time period. The extent to which its technology will be made available beyond the USSR is very uncertain and poses a question which OSI cannot, under any circumstances, answer alone. Chinese developments represent a special case which will be considered separately. In many regards the projections made here are pessimistic from the point of view of OSA's problems. Projections so far into the future are generally apt to be. We cannot anywhere with assurance reduce the projected threat, however, and it does provide a threat limit against which your concepts may be considered.

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Soviet Threat

3. Three major developments characterize the current course of Soviet air defense efforts: the wide deployment of the SA-5 (Tallinn System), the possible deployment of a nuclear version of the SA-2 Guideline missile, and the improvement of the low altitude tracking capabilities of the air surveillance network. All three of these developments are likely to have an impact on Soviet air defenses in the 1975-1980 period.

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It will probably constitute the principal Soviet defense against high altitude aircraft in the foreseeable future.

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Since development of the system is believed to have been generated in part by a need for improving defenses against stand-off air-to-surface missiles, it appears likely, however, that this radar can detect and track targets of small radar cross section at substantial ranges.

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5. If the SA-2 Guideline missile is now being deployed with a nuclear warhead as appears possible, the SA-2 system is likely to be kept operational through the late 1970's. Current estimates of this new deployment indicate it will affect about 500 SA-2 sites and provide a mixed missile arsenal at each site. No clearly defined improvement in SA-2 capabilities because of the use of nuclear warheads is as yet evident but the long range of nuclear damage effects will greatly reduce the burden on other components so as to improve system capabilities against a broad range of targets. With this general guidance in mind, it must also be recognized that widespread deployment will allow the Soviets an immediate and widespread option for making a nuclear response to an aerodynamic intrusion. All of the rather significant political ramifications associated with using a nuclear weapon are likely still to apply, however, in this time period.

6. The further deployment of air surveillance radars to improve coverage against low altitude targets which is now evident is expected to continue during the next 10 years. While continuous tracking of low altitude targets throughout the USSR will probably not be possible at the end of that period, approach routes and the principal target areas will be well covered to altitudes somewhat below 500 feet. It appears likely that this air surveillance network will be extended to include the Warsaw Pact countries on the western approaches to the USSR.

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7. Continuing improvement on other air surveillance and GCI radars is expected which will improve their detection and tracking performance, their resistance to ECM, and will continue to develop the broad range of frequency diversity among Soviet radars.

8. It is further estimated that an improved low altitude SAM system will become operational in the USSR in the early 1970's. (If the system has extensive medium altitude capabilities so as to allow it in combination with the SA-5 to replace the SA-2 system, it may not emerge until the mid-70's.) Such a system would provide a defense against aircraft flying at altitudes below 500 feet and--once again, because of the requirements for coping with advanced ASMs--be able to handle targets of very small radar cross section. Projections made in 1967 call for possibly as many as 400 low altitude SAM sites during the period in question. Deployment at this level would not provide total low altitude defense but would cover likely approach routes and high priority target areas.

9. By the early 1970's it is estimated that the Fobbat interceptor aircraft will become operational with an AI radar and air-to-air missiles giving it a "shootdown" capability against low altitude targets. An advanced all-weather Mach 3 cruise interceptor may also be developed and introduced in the mid-1970's. It would also have the ability to cope with low altitude targets but, additionally, have the range of the Fiddler. Such an interceptor could pose a threat to Mach 3 aircraft flying as high as about 120 thousand feet. More fully automated command and control links are expected to be in wide use by the 1975-1980 period.

10. These projections of Soviet air defense developments are, of course, grounded in a period when major strides forward are being taken. This high pace of development has largely been generated by the U.S. strategic bomber threat.

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If this threat significantly wanes early-on, some of the later developments may not occur or may be delayed. There is no reason to believe now, however, that such a departure from the projected course of events will occur.

Soviet ABM Defenses

11. Major expansion in the deployment of Soviet ABM defenses is expected during the next 10 years. The possibility of a treaty establishing a strategic arms limitation remains, but cannot be counted on to slow the pace of this deployment. The effect of this anticipated spread of ABM defenses is to pose serious problems for the very high, very fast, aerodynamic reconnaissance vehicle.

12. Of particular importance is the estimate that forward, initial acquisition and tracking radars of the Eon House type will be further deployed so as to cover the Polaris missile threat to Moscow and other critically important regions of the country.

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The principal advantage of such a vehicle--the difficulty of their acquisition early enough for defenses to react--is specifically countered by these phased array radars with their rapid surveillance of a large volume of space. Their detection range will be horizon limited against any imaginable reconnaissance vehicle cross section. The projected deployment of these radars calls for some 10-16 of them by the mid-1970's. This will provide a radar barrier around the heartland of the Soviet Union against the ICBM and SLBM threats. Since these radars will have an ABM role, their data handling systems will probably rely heavily on Kepler and may lack the software necessary for extrapolating the non-Keplerian tracks of vehicles such as aircraft. Apart from this limitation, their tight command and control netting and reliance on rapid data transmission systems will ensure their effective integration within Soviet defenses.

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13. In addition to these forward radars, "defended region radars" of the Dog House type are expected to be deployed in those areas to which ABM defenses are extended. These radars, which will probably be descendants of the basic Dog House CW, swept-FM technology will have formidable tracking capabilities against small targets throughout a large volume of space. Unlike the Ben Houses which are located hundreds of miles forward of the terminal defensive elements, these radars will be located within a defended region near the interceptor missile batteries. This makes it possible to effect the handover to the engagement radar or even to attempt intercept on the basis of actual tracking without the need for track extrapolation. Some 6 to 28 of these radars are currently called for in the mid-1970's by deployment projections. They will be located so as to provide protection to the principal urban-industrial concentrations against the ICBM and, probably, SLBM threats.

14. Current Moscow defenses are believed to rely on the Galosh missile and the Triad target track and missile track radars for intercept. The Galosh is a long range interceptor relying on exoatmospheric kill with a large yield, nuclear warhead. The Triad radars have visible characteristics suggesting that they are capable of fairly precise tracking. Though only 64 missiles are now expected to be deployed about Moscow, some 500 to 2000 long range interceptors are expected by the mid-1970's. These interceptors would pose a serious threat to any high altitude, high performance targets in this time period if resort to nuclear kill is acceptable. A non-nuclear threat from this same hardware might emerge from its use in an antisatellite role as discussed below.

15. In addition to these long range interceptors, it is believed likely that the Soviets will deploy an endo-atmospheric, high acceleration antimissile-missile capable of taking advantage of atmospheric discrimination techniques. If deployed, such a missile would provide terminal defense of high priority targets with a very fast response. These

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interceptors might be associated with advanced phased array radars providing both target and missile tracking. While these missiles would pose a significant threat to high performance reconnaissance vehicles, their use would probably involve nuclear kill unless a non-nuclear warhead were developed with this distinct purpose in mind. While this seems unlikely without clear provocation, it should be noted that the use of Sprint missiles for air defense as well as ballistic missile defense is now being seriously considered in the U.S. Under these circumstances, the development of an advanced HE warhead might not be an unreasonable undertaking. Projection 10 years hence of as many as 1200 short range interceptors has been made.

16. It is very unlikely that ballistic missile defense will be seriously undertaken beyond the USSR in the 1975 to 1980 period. In consequence, the threat that these defenses pose to high performance vehicles will be limited to the Soviet Union alone.

Soviet Antisatellite Defenses

17. No defensive system has been identified in the USSR which appears to have been designed specifically to intercept satellite targets. It is not unlikely however that the Soviets have provided themselves with a contingency capability to take action against them should cause be given. Such a capability would most likely be based on ABM technology in general and on the Galosh missile--Triad radar combination, specifically. Investigation of the antisatellite possibilities inherent in this combination has shown that the non-nuclear kill of satellites with altitudes and cross-ranges of several hundred nautical miles is possible. The Triad radar would provide ground guidance to the Galosh which could be equipped with an advanced, non-nuclear, pellet warhead. A long-wave IR homing guidance system employed atop any of a number of existing missile systems might also allow non-nuclear intercept

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though this possibility requires the postulation of homing system development. Occam's Razor consequently favors the Triad/Galosh combination utilizing only hardware known to exist.

18. These antisatellite possibilities are important in providing a possible source of motivation for the development of a non-nuclear warhead for use with the high performance, rapid response elements of Soviet ABM defenses. Such a system is geared up to overcome many of the susceptibilities such as timing errors and slow reactions which tend to degrade the air defense threat against very fast targets.

19. In addition to these terminal elements of a postulated Soviet antisatellite system, a Hen House space surveillance network has been deployed across the USSR which will make the undetected penetration of the southern border difficult for vehicles flying at high altitudes. If a capability for processing non-Keplerian data is included, the extrapolated tracks of vehicles penetrating the network from the South could be passed to downstream defenses. Alerting would occur under any circumstances. It is likely that these radars are netted with the ABM surveillance radars so that an extensive capability for detecting intrusions which might escape more slowly scanning air surveillance radars exists.

Chinese Air Defense Threat

20. The widespread deployment of a native Chinese version of the SA-2 system is currently underway. The extent of intended deployment of this system is unknown. If it were to provide coverage of current advanced weapons development areas at a level comparable to that in the Soviet Union, some 20 areas would be defended by a total of 80-100 SA-2 battalions. Such a level might be achieved in the early 70's with further extension continuing into the time period

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in question which would provide air defense for new important target areas developing in the course of time. In general, it is likely that by the 1975-1980 period, Communist China will have deployed air defenses sufficient to provide coverage of nearly all the high priority targets within the country. These defenses will probably consist of an improved version of the SA-2 or some offshoot developed at the Chinese test range. Its capabilities will probably allow it to pose a meaningful threat to aircraft flying at speeds of about Mach 3 and at altitudes approaching 100 thousand feet. Resistance to ECM will almost certainly constitute a major developmental goal.

21. With the improvement and extended deployment of Chinese SAM systems, the air surveillance and command and control networks will be upgraded. Though they may be inadequate for coping with a large scale attack in this time period, they will be fully capable of assuring the effective use of deployed weapons against intruders on surveillance missions.

22. It is likely that a natively produced version of the MiG-21 interceptor will form the mainstay of the Chinese air force through the mid-1970's. At that time a new interceptor may be introduced. It is unlikely that a new aircraft introduced in this time period will have substantially improved performance; it is more likely to be an achievement in terms of native Chinese technological development. Nevertheless, by the end of the time period in question such an improved interceptor will probably be widely deployed with compatible weapons and radar systems. A look-down radar capability will probably not be included during this period.

23. It is unlikely that the Chinese will have taken any major steps toward the deployment of ABM defenses in this period. The development and deployment of a surveillance

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system able to track passive satellites or other space objects may take place, however, in the 1975-1980 period. If this estimate is correct, such a fence would probably be deployed so as to create an east to west fence across China. Like the Soviet space surveillance network, it would allow detection and tracking of high performance vehicles passing through.

Other Defensive Environments

24. It is difficult to generally characterize the defensive environments of other states in this time period. The proliferation of air defense technology and the sale of equipment by a number of countries broadens the range of equipment possibilities in many areas of the world. In general, it must be assumed that weapons systems capable of dealing with Mach 3-4 aircraft at altitudes approaching 100 thousand feet will be available to those states which want to make such an investment. This equipment will probably be susceptible, however, to significant degradation in the presence of ECM. The density of the deployment and the effectiveness of concomitant air surveillance and command and control networks are likely to be substantially below those found in the USSR, the Warsaw Pact countries, or China.

Impact on Surveillance Vehicle Concepts

25. From this projection of the threat to a survivable, quick-reaction, reconnaissance vehicle in the 1975-1980 period, some judgments as to viable operating regimes can be drawn. Major uncertainties about the threat make their tight delimitation impossible.

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a. The reduction of radar cross sections as a measure aimed at preventing detection by air surveillance radars appears to be an unprofitable approach. This state of affairs has already been reached in the case of Soviet, Chinese, and North Vietnamese targets.

b. As a result, the undetected intrusion of the USSR or China can probably be accomplished only through the denial of recognition rather than operation below the detection threshold.

c. Though low altitude detection is likely in these countries, continuous tracking may not be maintained. Good low altitude coverage will probably exist, however, in high priority target areas.

d. Long range intercept of Mach 3 aircraft at altitudes of 100 thousand feet or greater by interceptor aircraft will be possible in this time period. This capability--which may be geographically widespread--could pose problems to the deployment of reconnaissance vehicles from mother aircraft or to reconnaissance operation outside the territorial limits of the target country.

e. Penetration of the Soviet Union at very high speeds and altitudes which might render existing air surveillance radars largely ineffective, will be countered in the 1975-1980 time period by the extensive surveillance capabilities of forward acquisition and initial tracking ABM radars. This coverage will be oriented against the ICBM and SLBM threats but may be both peripheral and internal in certain high population or critical target areas. Concern with ballistic missile threat sectors may allow some flexibility in the selection of penetration routes but the internal coverage of high priority target areas is likely to reduce the value of simply penetrating ABM radar barriers.

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f. Reconnaissance vehicles--like Isinglass--will enjoy the advantage of operating between the standard aerodynamic and ballistic threats for a time. The basic capabilities of projected Soviet ABM systems will be such, however, that software modifications or additions will reduce the effects of these advantages. The projected ABM deployment calls for a fairly large commitment in this area. If it is in fact substantially less than this, particularly in terms of radars within defended regions, Soviet ability to maintain track on very high performance vehicles like Isinglass will be greatly reduced.

g. Outside the USSR, the reliable detection and recognition of this type of intrusion will be unlikely 10 years from now.

h. Anticipated Soviet responses to developmental requirements posed by small, stand-off aerodynamic targets on the one hand and those posed by very small RV cross section on the other also denigrate the outlook for reliance on radar cross section reduction as a device for defeating the guidance radar elements involved in the engagement phase. This will probably generally characterize other advanced air defense technology though to less of an extent than in the USSR.

i. It is within the possibilities allowed by current uncertainties that the high altitude air defense provided by the SA-5 system may be able to cope with aircraft flying as fast as Mach 7 and at altitudes up to about 130 thousand feet. Though the performance of the system may be significantly less than that, this possibility cannot now be ruled out. SA-5 deployment will provide both barrier and local defense of high priority target areas. SAM performance at the level considered here would be limited to the Soviet Union during the period in question.

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j. Should the Soviets choose to make a nuclear response to reconnaissance aircraft intrusion, they will have several weapons systems deployed for such use. The range of capability--from SAM to ABM defense--will effectively put in jeopardy any type of high performance reconnaissance vehicle. It is unlikely that any other currently unfriendly country will have an immediately available nuclear capability in this period.

k. The urges for the development of an anti-satellite capability may well provide the Soviets with advanced non-nuclear warheads for use with ABM interceptors. The availability of such warheads would allow the early non-nuclear use of ABM hardware against high performance reconnaissance vehicles. In general, the capabilities of ABM weapon systems will merge with those of the SA-5 system so as to create an intercept capability able to cope with targets at all regimes of aerodynamic operation.

l. Outside the USSR, reconnaissance vehicles able to operate at speeds of Mach 5 at altitudes above 100 thousand feet should be able to operate with relative impunity in the 1975-1980 period. This speed requirement can probably be relaxed to the Mach 3 region with the effective use of ECM.

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DONALD F. CHAMBERLAIN
Director of Scientific Intelligence

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